

“Big Ideas” from the Watershed Unit

1. Energy from the sun drives the water cycle.
2. Point-source and non-point source pollution affects the quality of Delaware watersheds.
3. Topographic and land use maps can be used to identify sources of inflow or discharge into a watershed.
4. The health of a watershed can be determined by collecting and analyzing biotic and abiotic data.
5. The permeability of earth materials affects the quality of groundwater and where it is located.
6. Riparian buffer zones can have a beneficial impact on surface water.
7. Humans can have a positive or negative impact on Delaware watersheds.

Name: _____

School: _____

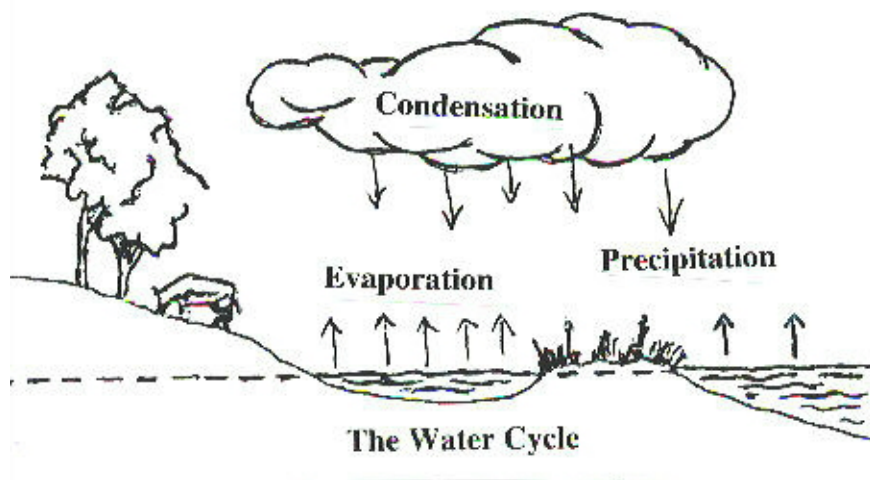
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District: _____

Watershed Summative Assessment

Part I. Water Cycle

- Below is a picture from an elementary science textbook that illustrates the movement of water. What additions would you make to the illustration to demonstrate a more complete understanding of the movement of water? Be sure to include appropriate labels in your illustration.



- Explain the path water travels in your diagram.

3. Clay, gravel, and sand are examples of Earth's materials. How does the particle size of these Earth materials determine the rate at which water moves? You may include a diagram in your response.

Part II. Evaluating the Wiggins Mill Pond Watershed

The Delaware Department of Resources and Environmental Control (DNREC) has asked you to investigate the Wiggins Mill Pond Watershed. It is your job to determine the health of this watershed and to consider how a suggested recommendation might affect the watershed. In order to evaluate the health of the watershed and to determine the effects of the recommendation you will need to carefully study the data sheets and maps that are included in the Wiggins Mill Pond Data File. Before you begin Part II of this assessment make sure that your file includes the following:

- one topographic map
- one land use map
- two water quality data sheets
- one water quality parameters sheet
- one Stream Insects and Crustaceans Sheet

If any information is missing from your packet, please inform your teacher immediately before attempting to complete the following questions.

4. Look carefully at the topographic map. The boundary for the Wiggins Mill Pond Watershed has been drawn. Explain why the Delaware Department of Natural Resources drew the boundary for the watershed in this way.

5. Study your land use and topographic maps. Identify a land use that may affect the Wiggins Mill Pond. Is this land use a point source or a non-point source of pollution? **Explain why.**

6. A recommendation has been made to create riparian buffer zone(s) along Wiggins Mill Pond. The two recommended sites are marked A and B on the map below. Using information from your topographic and land use maps, choose the best location for this buffer zone. Explain your choice using evidence from your maps.



7. Now compare the Wiggins Mill Pond water data sheets to the water quality parameters. Identify any data from the sheets that may indicate a problem with the quality of the water in the pond. **What might have caused the problem?**

8. Use the data from the Water Quality Data Sheets, Stream Insects and Crustaceans sheets, and Water Quality parameters sheet. Which invertebrate group (Group One, Group Two, or Group Three) would you expect to find in the pond? Explain your choice.

9. Scientists who study watersheds spend a lot of time trying to determine what kinds of macro invertebrates live in the watershed. Your neighbors may not understand why this data is important to their lives. How would you explain to your neighbors why the living organism data is important to them?

Wiggins Mill Pond Data File

The Following Information Is Included:

- one topographic map
- one land use map
- two water quality data sheets
- one water quality parameters sheet
- one Stream Insects and Crustaceans Sheet

Non-Tidal Water Quality Data Sheet

Sample Date: 10/16/01, 2:30 A.M.

Sampling Team: DNREC Scientists

Location Sampled	Wiggins Mill Pond
Water Temperature in Degrees Celsius	15° C
Degrees Fahrenheit (1.8 x C + 32)	59° F
Hydrometer Reading	1.000
Salinity	.5 ppt
Dissolved Oxygen	3 ppm
Nitrate	11 ppm

pH	7.0
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Non-Tidal Water Quality Data Sheet

Sample Date: 10/16/01, 12:00 P.M.

Sampling Team: DNREC Scientists

Location Sampled	Wiggins Mill Pond
Water Temperature in Degrees Celsius	18.5° C
Degrees Fahrenheit (1.8 x C + 32)	65.3° F
Hydrometer Reading	1.000
Salinity	.5 ppt
Dissolved Oxygen	10 ppm
Nitrate	11 ppm
pH	7.0

Water Quality Parameters

Nitrates

- Limit 10 ppm in public water supply to safeguard infant well being
- Best if less than 3 ppm in freshwater streams, and more may indicate organic pollution, such as fertilizer or feedlot runoff, or sewage contamination.
- Elevated nitrate levels may cause algal bloom (overgrowth).

Phosphates

- Limit 0.5 mg/L in drinking water.
- Wastewater often has 30 mg/L.
- Best if less than 0.1 mg/L in streams as elevated levels can trigger algal blooms.

PH

- 6.5 to 8.5 is best range for sensitive fish and almost all invertebrates.
- 5.0 to 9.0 is suitable for human consumption.
- Below pH 4.5, few fish and invertebrates can survive.

Hardness (measured in mg CaCO₃/L)

- 0-75 soft water.
- 75-150 moderately hard water.
- 150-300 hard water.
- 300+ very hard water.
- The harder the water, the more likely deposits will build up in pipes and in water heaters. Both calcium and iron salts in water cause hardness. High levels of hardness limits the foaming or lathering capacity of soaps.

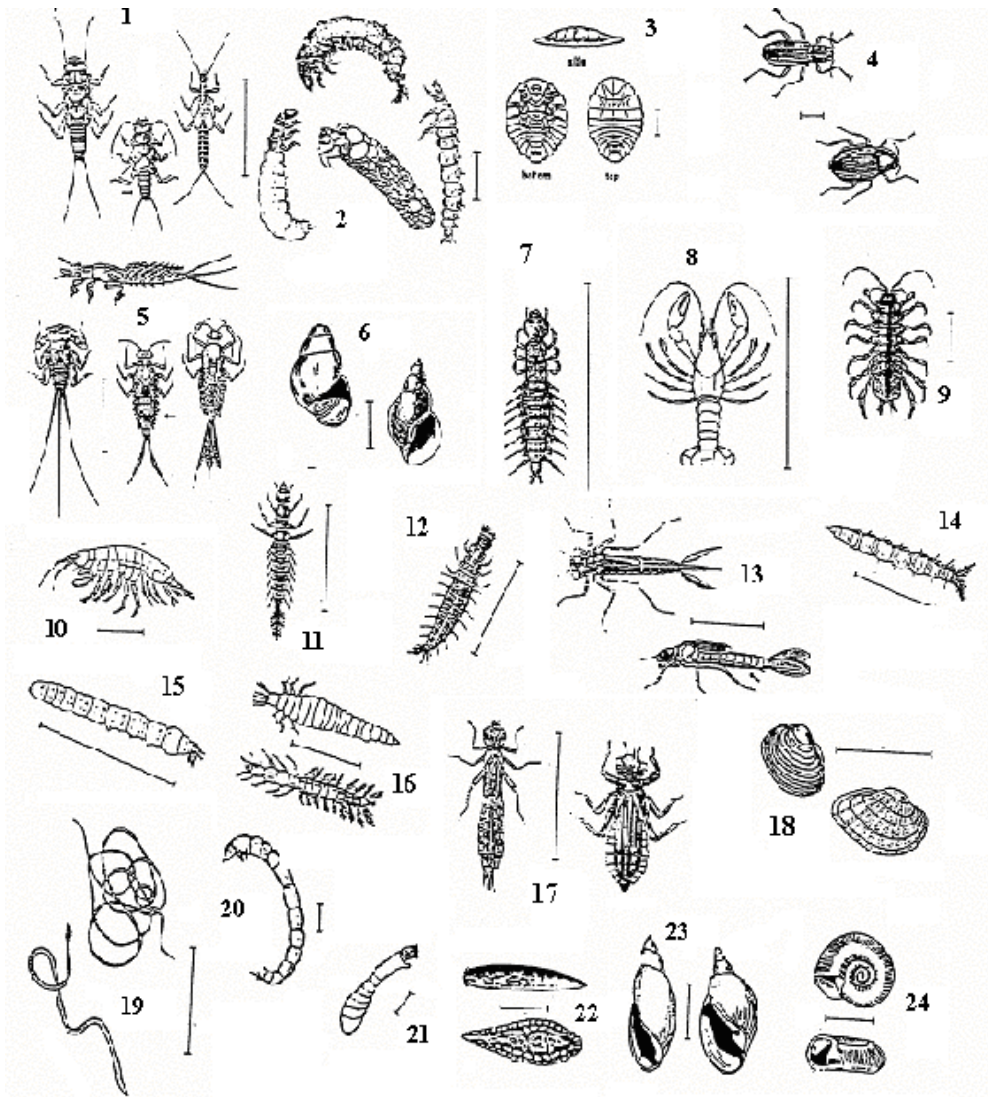
Salinity

- Limit of <.5 ppt in drinking water.
- <.02 ppt in unpolluted water.
- Along roadways, during the winter, road salt may increase levels up to 18 ppt in rural areas, and 45 ppt in urban areas.
- Salts also enter water through industrial and human/animal wastes, and soil leaching

Dissolved Oxygen

- Cooler water holds more oxygen than warmer water.
- 6 ppm or more dissolved oxygen is necessary for oxygen sensitive fish, and many invertebrates.
- Most fish cannot tolerate less than 4 ppm dissolved oxygen.

Stream Insects and Crustaceans



Group One Taxa	Group Two Taxa	Group Three Taxa
Pollution sensitive organisms found in good quality water. <ol style="list-style-type: none"> 1. Stonefly 2. Caddisfly 3. Water Penny 4. Riffle Beetle 5. Mayfly 6. Gilled Snail 7. Dobsonfly 	Somewhat pollution tolerant organisms can be in fair quality water. <ol style="list-style-type: none"> 8. Crayfish 9. Sowbug 10. Scud 11. Alderfly larva 12. Fishfly larva 13. Damselfly 14. Watersnipe Fly larva 15. Crane Fly 16. Beetle Larva 17. Dragon Fly 18. Clam 	Pollution tolerant organisms can be in poor quality water. <ol style="list-style-type: none"> 19. Aquatic Worm 20. Midge Fly Larva 21. Blackfly Larva 22. Leech 23. Pouch Snail and Pond Snail 24. Other Snails

